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Neural Characteristics of Affectionate Communicators: Trait Affection and Asymmetry in the Prefrontal Cortex

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Dedication

This thesis paper is dedicated to Rikki and Jack. For loving one another, for our passions, and for the support you give to me, I will always be thankful.

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Abstract

Individual differences in thresholds for affectionate communication should be reflected by differences in neurological structure and function. A theoretical schema from several overlapping literatures including evolutionary psychology, social neuroscience, fundamental personality, and communication are examined to make the case that high-affection communicators have greater relative electrical activity in the left prefrontal cortex (PFC) versus the right PFC reflected in asymmetrical baseline EEG recordings. Participants (N=16) reported trait-affection levels using Floyd's (2002) TAS-G, which measures an individual's threshold for expressing affection. Participants' baseline electrical activity was then recorded. Asymmetry was operationalized as the difference between microvolt (μV) values of laterally opposed electrode clusters thought to measure PFC activity. Correlations and a discriminant analysis are consistent with the hypothesis that high-affection communicators have greater relative left PFC activity than less affectionate communicators. Using this sample, data indicate that sex also covaries with asymmetrical processing. Possibilities for further investigation and weaknesses of the current study are discussed in detail.

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Chapter One:

Introduction and Literature Review

Affectionate communication is an adaptive trait that stimulates humans to gain reproductive and survival rewards by forming and maintaining relationships (Floyd & Mikkelson, 2004; Floyd, 2006a). It also plays a crucial role in the psychological development of infants and children, even when affection is experienced vicariously (e.g., Cummings et al, 1981). Observations indicate that children reared by parents who express high levels of affection have fewer problems associated with adjustment, fewer conduct disorders, and higher peer affiliation (Aunola & Turmi, 2005). The amount of physical affection expressed by mothers to infants in primitive cultures predicts very closely that particular culture's predisposition toward violent behavior (Prescott, 1979). In fact, receiving affection has been identified as a basic survival need by a number of researchers (e.g., Baumeister & Leary, 1995; Maslow, 1970; Rotter et al, 1972). The ability to express affection has important implications for the source as well as the recipient (e.g., Floyd, 2001, 2002, 2006b, in press). For example, research indicates that highly affectionate communicators tend to be happier and have higher self esteem, less fear of intimacy, less susceptibility to depression (Floyd, 2002), healthier attachment styles, and higher relationship satisfaction. Their bodies are better capable of managing stress, and evidence indicates that they have healthier cardiovascular and metabolic systems (Floyd, 2005, 2006, 2007). Among the vast number of factors that influence physical well-being, from diet and exercise to dental hygiene and sleeping routines, communicating affection seems to be one of the most fundamental. It allows the body to reduce stress thereby directing more resources to its maintenance systems (Floyd, 2006b). This observation helps to account for why highly affectionate communicators differ on these psychological, behavioral, and health variables when compared to their less affectionate counterparts.

Affection

Laypersons and scholars alike often differ in how they conceive of affection. For example, is the act of embracing another person in and of itself affection or is it merely a symbolic act representing affection? If embracing is merely symbolic, what is the impact on the emotional state it represents? Making clear definitions and distinctions regarding affection-related phenomena is an indispensible part of any critical inquiry on the subject.

Expression

There is evidence to suggest that emotional states and the behavioral expressions thought to reflect those states do not represent a linear or unidirectional relationship. In other words, the behavioral expression of emotion need not presuppose the existence of an emotional state. Rather than simply being a consequence of emotion, Charles Darwin (1872/1965) suggested that physiological changes could directly impact emotional states. Commonly referred to as the *Facial Feedback Hypothesis*, researchers have argued that the physical act of smiling, frowning, and related facial expressions can directly impact the self-perception of emotional states. An extreme position on this hypothesis would posit that facial feedback alone can produce emotional states whereas a more moderate position contends that the feedback merely enhances or diminishes existing emotional states (see Zajonc, Murphy, & Inglehart, 1989). Indeed, several studies support the idea that facial feedback does impact emotional states (e.g., Lanzetta, Cartwright-Smith, & Eleck, 1976; McCanne & Anderson, 1987). Additionally, a number of neuroscientific studies have linked mere mimicry of facial expressions with the same patterns of brain activation observed with the emotions they typically represent (e.g., Goleman, 2006). As a result, some scholars would argue that emotional states cannot be considered independent of the physiological states associated with them. However, whether those physiological states must be manifest in overt behaviors is another matter.

Conceptualization of Affection

Floyd (2006, p. 4) defines affection as an "emotional state of fondness and intense positive regard that is directed at a living or once-living target." As a consequence, the specific behavioral cues commonly associated with affection (e.g., touch, speech, facial expression, etc.) often co-occur but are fundamentally independent of one another. This definition distinguishes affectionate communication from its related affective state, which may or may not accompany one another. For example, a person may express affection in the form of social support for a monetary reward or professional gain, even when that person feels no affection for the receiver. Likewise, the emotional state may not be accompanied by its expression. An example of this scenario is someone who hesitates to express affection during the initial stages of a relationship for fear that it might not be reciprocated or that it might make the other person uncomfortable. Both of these aspects of affectionate communication are important to the current study.

Trait Affection and Fundamental Personality

Trait affection refers to a person's predisposition toward experiencing and/or expressing a state of affection. Although states are transitory, the predisposition to experience a particular state and to express that state behaviorally—from a trait perspective—is thought to be relatively stable across time and context. Anecdotal evidence and Floyd's (2002, 2006a) research suggest that individuals differ in their tolerance for expressing affection and that this difference is distinct from their ability to encode the message. Of course, the mechanisms which motivate some humans to express more affection than others are not conceptually distinct from fundamental temperament and personality (Floyd, 2006). Exactly how trait affection is related to these fundamental personality systems requires a multifaceted approach which involves several levels of analysis, including the physical mechanisms from which personality constructs emerge.

Variation in Affection

There are several converging—and sometimes competing—perspectives that provide a theoretical schema for investigating why (1) individuals differ in thresholds for affection in general, and (2) why there are health and relational benefits associated with giving and receiving affectionate communication. An examination and critique of these competing theories and approaches is therefore warranted. Using extant literature in human communication proper, as well as the literatures of various other relevant disciplines, a comprehensive explanatory background for the current investigation will be elaborated.

The Culture-centered Approach

A culture-centered approach posits that affection and its expression are derived primarily from the rules and norms of a person's culture rather than individuals themselves. Theories that fall under this approach focus on how learning shapes behavior and on culturally prescribed meanings. These theories generally de-emphasize or completely discount the role of innate mechanisms in affection. Two well known theories that support a culture-centered approach include Bandura's (1971) social learning theory and Burgoon & Newton's (1991) social meaning model. Contained within the core of such theories is the assumption that certain behaviors are symbolic *only* because cultural groups prescribed them particular meanings. This orientation suggests that cultures should vary widely in their orientation toward affection. However, evidence suggests that a certain amount of semantic consistency in emotion actually *does* exist among and between completely disparate human cultures. For example, a number of facial expressions have been found to have a degree of universality across cultures (e.g., Ekman, 1999b). Additionally, mothers (regardless of culture or language) use higher-pitched vocalizations to express affection to infants and children (Cook & Newson, 1996). There are hundreds of such universal human traits (Pinker, 2003). Proponents of the culture-centered perspective must deal with the paradoxical evidence presented in such studies. One example of a culture-centered approach to affection is *Expectancy Violations Theory* (EVT). EVT posits that individuals have expectations concerning the behavior of others and that when individuals notice a divergence in these expectations they become aroused. According to EVT, this arousal compels the individual to evaluate the valence of the sender (for reward potential) to see whether the behavior should be interpreted positively or negatively (e.g., Burgoon, 1978). Thus, EVT can help explain why the same affectionate messages might be interpreted negatively or positively by different receivers (Floyd & Voloudakis, 1999). As a complement to EVT, Burgoon & Newton's (1991) *Social Meaning Model* (SMM) predicted that individuals in a given community should interpret behavior similarly with respect to its relational value, which can account for relative consistency in affectionate messages and behaviors within particular cultural groups. Additionally, *Interaction Adaptation Theory* (e.g., Burgoon, Dillman, & Stern, 1993) can likewise be used to predict whether receivers will reciprocate or compensate for a sender's affectionate messages (Floyd & Burgoon, 1999).

Limitations. To be comprehensive, a culture-centered approach must be able to explain variation in the expression of affection within a given culture. If culture alone were responsible, individuals with different cultures should have incommensurable attributes. This is not the case. As it is, none of the culture-centered theories presented account for individual predispositions which may or may not be consistent across time or context. The strength of these theories lies in their ability to predict specific outcomes, which they do reasonably well. However, they do not effectively discredit the evidence supporting universality—meaning that data used to support these theories may reflect innate mechanisms. Furthermore, these theories do not address or acknowledge any role—real or potential—for individual biology in mediating expression and response to affection. A complete account of all affection-related phenomena requires a different approach.

The Biology-centered Approach

As an alternative to the culture-centered approaches, many researchers have taken a biology-centered approach to affection. Biologically centered theories focus on two types of analysis: natural selection and human psychophysiology. According to this perspective, analysis is centered on individuals' biological mechanisms rather than the social levels represented by the culture-centered theories described in the previous section. For example, Darwin's (1872) *Theory of Emotion Expression* contends that although affectionate behaviors may not seem to be of any direct use, they exist because of inherited habits associated with biological parents' provisioning for offspring.

Similarly, Baumeister and Leary's (1995) *Need to Belong Theory* (NTB) posits that individuals have a fundamental motivation to form strong relationships. The theory predicts that individuals have an inherent need not only to receive affection, but to give it as well. Whether this is a function of natural selection or some other phenomena is not explicated, but the theory presumes that it is an individual (biological) need rather than a need derived from one's culture. Furthermore, the theory predicts that there are non-psychological rewards (e.g., improved physical condition) for expressing and receiving affection. NTB does not, however, provide an explanation nor specific mechanism for why this should be so.

Concerning female affectionate behaviors, *Tend and Befriend Theory* (Taylor, Klein, Lewis, Gruenwald, Gurung, & Updegraff, 2000) suggests that in human evolution, females who befriended other females were more successful in ensuring that their offspring survived long enough to procreate. Because other females could provide support if the mother was injured or if resources were scarce, offspring whose mothers befriended other females were more likely to survive. It is difficult to conceptualize befriending without some degree of positive regard and expression. Therefore, it is reasonable to suggest that females who were more skilled and motivated in communicating affection were at an advantage in this regard. From the standpoint of heritability, their children were more likely to be carrying the same genetic code that made them successful encoders of affectionate messages, which allowed the advantage to pass on. Likewise, tending to their offspring involved verbal and nonverbal expressions of affection and support, which has been related to normal development in infants. The research of Harry Harlow (1906-1981) is relevant in this regard. Harlow (1962, 1964) was interested in the development of affection and the consequences of social deprivation in monkeys. Although unethical in nature, Harlow's studies showed there were dramatic and long-lasting effects of social deprivation. Harlow noted that in his experiments with monkeys placed in total isolation for six months that when returned to the social group, one out of six refused to eat upon release and died within days. The social orientation of monkeys was nearly completely destroyed after twelve months of isolation, and rehabilitation efforts were met with limited success (Harlow, 1965). Social deprivation can be viewed as a stressor, while tending and befriending are conceptualized as responses to stress. These theories are relevant because they predict the stress-relieving benefits and positive health outcomes of affectionate communication. Tend and Befriend helps to explain variation in ability to encode affectionate messages through natural selection, and Harlow's experiments support the notion of an innate need for affectionate communication.

Related to Harlow's work is Prescott's (1970) *Somatosensory Affectional Deprivation Theory* (SADT), which focuses on mothers' behaviors toward offspring and how those behaviors affect developmental outcomes. The theory states that human infants need tactile, olfactory, and locomotive stimulation in order to prevent developmental delays and other problems. According to SADT, infants lacking such stimulation will fail to form an emotional bond with their mother (or primary caregiver), which can lead to the failure later in the infant's life to form positive sexual bonds and to express affection to their own offspring. From a biological perspective, this not only reduces opportunities to procreate but risks passing on the maladaptation to later generations. According to Floyd (2006b), SADT is valuable in researching the therapeutic effects of touch, cultural violence, and drug addiction with relation to child development. Harlow's studies using surrogate mothers with monkeys supports this notion. When Harlow gave isolated monkeys a choice between (1) a wire-framed surrogate "mother" monkey with a milk bottle, and (2) a soft, warm, surrogate; young monkeys inevitably preferred the latter. Indeed, the monkeys spent as little time as possible on the wire-framed surrogate, despite the fact that its' very survival depended upon the milk it provided. Instead, the young monkeys would cling to the surrogate that provided tactile stimulation until hunger forced them to go to the wire-framed food source. When exposed to a frightening stimulus, the monkeys would go to the soft surrogate rather than the wire-framed food source. When both the soft and wire framed surrogates provided food, monkeys with the wire-framed food source had more health problems. Harlow argued that psychological stress caused by the lack of tactile stimulation was responsible (Harlow, 1959).

Limitations. As with the culture-centered approaches, biological approaches tend to focus only on a cross-section of affectionate communication (e.g., child development, female affection) while leaving out certain relevant components. The *need to belong theory* focuses only on behavioral and emotional components while leaving out pressures of natural selection; Darwin's theory focuses on natural selection only while leaving out any specific physiological mechanisms for emotional expression; and Prescott's SADT and Harlow's monkey studies focus on the effects on physiology and development while ignoring ultimate causes for those behaviors. Although Harlow referred to underlying stress as a factor, later researchers combined hormonal markers with consequences of affectionate communication. Using the Tend and Befriend Theory, Carter et al. (1999) presented perhaps the most comprehensive biology-centered approach to affection. Carter et al. examined the role of the stress-reducing hormone oxytocin (e.g., Carter et al, 1999) on the expression of and need for affection in the context of natural selection pressures. However, the theory ignored other potential responses to (i.e., fight or flight) and manifestations of (i.e., failure to thrive), stress. Finally, as with culture-centered approaches, those who support a biology-centered approach to affection must explain why variation exists among individuals with similar biological makeup. Although the biology-centered approach would argue that variation is due to physiological differences, no theory has fully explicated the processes involved. Nevertheless, these theories are informative and their limitations merely underscore the need for a more comprehensive approach to the study of affectionate communication.

Communibiology: A Comprehensive Approach

First introduced more than a decade ago, *communibiology* is an approach to studying human communication that provides scholars with a framework that is useful for creating and testing communication theories and hypotheses based on biology as well as traditional communication variables. The basic auxiliary assumptions of the communibiological paradigm include the following: (1) All human communication is a function of brain activity; (2) brain structures responsible for temperament are highly heritable; (3) environment has a minimal effect on communication functioning; (4) and finally, communication traits and behaviors reflect adaptive traits associated with biological evolution (Beatty, McCroskey, & Valencic, 2001). The tenets of communibiology focus solely on biological processes, although manifestations of these processes may be responsible for observed cultural differences. Biological processes, according to the paradigm, are thought to underlie all temperamental variables, including variables thought to be derivative of temperament (e.g., temperament). Human communication is thus conceived as biological or *temperamental expression*.

Unlike approaches that rely on radical environmentalism, communibiology utilizes evidence and assumptions drawn from the natural sciences (e.g., biology, chemistry, neuroanatomy, neurophysiology, etc.) to posit and test communication theories. Of course, some scholars have pointed out that environmental and cultural variables have been erroneously given short shrift in Beatty, McCroskey, and Valencic's (2001) articulation of the paradigm (e.g., Condit, 2000). While Beatty, McCroskey, and Valencic did state that situation, environment, and culture play 'negligible' (2001, pp. 78-

79) roles in *communication functioning*, this was in the context of a single communication trait's effect size. Even so, Beatty and McCroskey differ in their interpretation of the data. McCroskey has argued that the variance not explained by biological factors may be due to cultural variables while Beatty argues that unexplained variance is due to imprecision in measurement and testing. In other words, while McCroskey views culture as a unique entity, Beatty sees culture as a collective manifestation of temperamental expression (i.e., individual physiologies and temperaments). From Beatty's perspective, the effect of environment is viewed as a biological process *with biological constraints.* Therefore, environment can impact communication function and behavior through interaction with existing biological constraints. Put simply, the environment does indeed play a role in temperamental expression. In fact, biological constraints are what make symbolic interaction and learning possible in the first place.

Ironically, research in human communication is more widely conducted in a framework consistent with biological constraints than critics of communibiology would like to admit—despite the fact that biology does not axiomatically guide the theorizing in these studies *per se*. Even without the widespread acknowledgment of the role of biological constraints in behavior and emotion, studies that support a biology-centered model are abundant. However, no approach has been fully successful as culture-centered approaches that ignore some or all biological constraints continue to be used to study human communication (e.g., Mischel, 2007; Pinchevski, 2005). This is largely due to their perceived utility for specific types of investigations and the apparent aversion some scholars have to biology—perceiving it as a "hegemonic male construct" (Condit, 2000).

Evolutionary Psychology, Genetics, and Natural Selection

Communibiology did not emerge by scholarly fiat. As with similar approaches in other disciplines (i.e., sociobiology and psychobiology), communibiology developed because a growing body of literature was evolving in several other disciplines that supported a different approach. This section introduces a number of these converging research programs and provides more background for studying affectionate communication.

In the past few decades, a substantial body of literature related to and directly concerning social phenomena like affectionate communication has been conducted under the rubric of *Evolutionary Psychology* (EP). EP represents an active and vibrant line of research (e.g., Cosmides & Tooby, 1997a, 1997b; Floyd, 2006a; Lickliter & Honeycutt, 2003). According to Cosmides and Tooby (1997b), evolutionary psychology "… is not an area of study, like vision, reasoning, or social behavior. It is a *way of thinking* about psychology that can be applied to any topic within it." (p. 1). The approach—which can trace its beginnings to Charles Darwin—examines how the human mind emerged from evolution, and how evolutionary processes and environmental constraints created the brain's functional structure. The approach has implications both on what kinds of physical structures and processes researchers should expect to find in humans, as well as the functions those structures and processes subserve.

Darwin (1859) proposed that adaptations (mutations of the genetic code) that happen to increase viability and fertility make some members of a species better equipped to reap rewards from their environment than others. *Survival of the fittest*, then, means that those members of a species whose mutations are better suited to their environment are more likely to survive and procreate than others. In this sense, fitness refers to the nature and degree to which particular mutations/characteristics positively interact with the environment. Successful mutations allow organisms to survive and reproduce more than those without that adaptation (e.g., sharper vision for catching prey, better camouflage, or a larger prefrontal cortex), while unsuccessful mutations (e.g., lack of pigmentation) might cause the organism with the mutation to be killed and/or reproduce less, thereby diminishing or extinguishing the mutation. If selection pressures in the environment remain constant, successful adaptations will become more common. However, there will still be variation among the species carrying the genetic code for the adaptive trait. Eventually the trait *may* become completely ubiquitous in the species (Darwin, 1859). Of course, such ubiquity would require a significant amount of time to arise as any constant in the organisms put the species at risk to drastic changes in the environment.

Evolution, through adaptive traits, shapes the behaviors of organisms over time by not only selecting behaviors that increase reproduction, but also by eliminating behaviors that are costly or unnecessary with regard to viability and fertility. In the most basic sense, any organism that exhibits biological movement is said to have *taxes. Taxes* are fundamental orientations toward stimuli (Rolls, 2000) such as avoiding water or brightly lit areas. These kinds of orientations are generally *selected for or against* in the process of evolution. Orientations are selected for when they increase survival and procreation, and selected against when they reduce survival and procreation. The orientation of a plant toward the sun is a basic example. The process of photosynthesis allows plants to convert sunlight into chemical energy, an orientation which evolved over time to capitalize on the near infinite light energy in the environment. Plants that developed better abilities to capture and convert light energy were more successful than competing plants. In other words, these plants were selected for an orientation toward sunlight.

Principles of Evolutionary Psychology

Evolutionary psychology is compatible with communibiology and offers a powerful lens through which communication researchers can begin to conceptualize the functional etiology of affectionate communication. Without such a foundation, the consequences of affectionate communication cannot be understood within the larger context of human communication and human relationships. After all, communication itself was a “selected for” mutation.

First principle of evolutionary psychology

When mobile organisms like animals respond to stimuli, the responses are called *tropisms* rather than taxes. Because of natural selection, mobile organisms have data receptors linked to biological mechanisms so that particular stimuli are approached while other stimuli are avoided. Implicated here is the *first principle* of evolutionary psychology, which states that the brain is a physical system governed by the laws of chemistry and physics, and that the brain has circuits, much like a computer “designed” to select and create behaviors appropriate to certain circumstances (Cosmides & Tooby, 1997). Reward and punishment with relation to goal structures thereby provides the organism’s *common currency* for algorithmic processing (Rolls, 2000). In other words, behavioral responses depend on a repertoire of responses and the relative reward and punishment associated with each. It must be noted from the outset, however, that in complex nervous systems (i.e., human brains) reward and punishment is generally in a constant state of struggle. A particular stimulus may be both a reward and a punisher, which is an idea that will be more fully elaborated later in the text. Nevertheless, the idea that selection pressures influenced human brains gives a basis for understanding their functional structure through the lens of EP.

In the context of human communication it is also necessary to examine exactly what is being selected for, why, and how that might affect the reward-punishment architecture of the human brain. When an adaptation succeeds, researchers are often quick to point out that it is "for the good of" the individual, his or her kin, or the group. Discussing this very topic, Floyd (2006) notes that "in circumstances when an individual's priorities conflict with a group's, adaptations tend to privilege the success of the individual over that of the group" (p. 159). Consistent with this statement, the basic unit of selection, according to Dawkins (1982) is the *optimon*. An optimon is the genetic code specifically responsible for an adaptation in the DNA of an organism. More fundamentally, it is the single allele between two competing alleles on a genome—the DNA code responsible for creating a particular trait—that is ultimately selected for (over group benefit *and* individual benefit). The genetic code responsible for creating the trait is what *always* "benefits" from an adaptation in that through its mere existence, it increases its chances of being replicated due to its role in the phenotypic effects of the adaptation (e.g., a bird's instinct to build a nest, the skin color of a poison-dart frog, or a human's affectionate emotions or behaviors). Decades of research on intragenomic conflict supports this gene-centered view (e.g., Burt & Trivers, 2006; Hurst, 1992; Haig, 1992; Tooby & Cosmides, 1997). The gene-centered view qualifies as the central core of a progressive scientific research program (Lakatos, 1978a, 1978b) due to its centrality in neo-Darwinian science and its predictions regarding modern evolutionary biology. In this view, an individual organism is only a vehicle carrying replicators for the sole purpose of perpetuating those replicators. In other words, people are simply a copy machine for the genetic code. This has implications for which types of functions one should expect to find in a nervous system's functional substrate. Adaptations that happen to benefit the survival of the group should be seen only to the extent that they benefit individual replicators, and likewise adaptations that happen to benefit the individual organism should be seen only to the extent that they benefit individual replicators (Dawkins, 1982).

Selection and affection. Using a game-theoretic approach, it has been shown that humans can be compelled to engage in altruistic behaviors, as well as other behaviors that seem to have no benefit to the individual human with regard to its own viability and reproduction, when placed in certain types of situations. For example, dopaminergic reward mechanisms in the human brain are sometimes "wired" to provoke humans to, for example, risk their own life for the sake of another. Anecdotal observations of primates' need for affection overriding their need for even food or water, and similar observations of humans underscores the innate need of individuals in every culture for affectionate communication (Floyd, In Press). It is therefore essential for researchers to keep in mind that as a consequence of evolutionary processes, structures in the brain may not function to improve the viability and reproductive opportunities of the individual organism per se. Rather, they may benefit the viability and reproductive opportunities of family or group members. In this way, replicators improve their chances of being copied by supporting multiple vehicles for a particular strand of genetic code and close relatives of it. In addition, functions can be “hijacked” by stimuli from other objects (living and nonliving) with a behavioral outcome that is ultimately maladaptive (e.g., obesity, drug addiction, obsessive-compulsive disorders, etc.).

To the extent that affectionate behavior emerged from evolution, we should expect to see neurological structures which “see to it” that individual humans have a built-in goal structures which lead them to manifest their respective adaptive traits (Cosmides & Tooby, 1992), consciously or unconsciously. To the individual, a *proximal* cause such as being lonely or desiring romantic affection can manifest the *ultimate* evolutionary cause for all traits, which are a combination of organismic viability and reproductive success in a dynamic environment (Floyd, 2006a).

Second principle of evolutionary psychology

Social behaviors, tendencies to approach rewards or avoid punishment, and emotional reactions related to affectionate communication evolved over millions of years of human evolution. Environmental variables of the Pliocene, Pleistocene, and earlier (also called the “era of evolutionary adaptedness”) (Cosmides & Tooby, 1997; Floyd, 2006a), as well as social selection pressures during that time are primarily responsible for what makes humans distinct as a species of primate. The rate that cultural and technological change in humans has occurred over the last several thousand years has far outpaced biological (human) evolution. Although natural selection and related processes continue to impact the species, the characteristics seen in humans today are not recent developments. Implicated here is the *second principle* of EP, which states that human neural circuitry evolved to solve problems that humans encountered during the era of evolutionary adaptedness. This distinction helps to clarify what is meant by the word "appropriate" as it was used in the first principle. Adaptive behaviors that might be appropriate for a dung beetle (i.e., hanging around piles of dung) were not appropriate for humans—even during the era of evolutionary adaptedness (Cosmides & Tooby, 1997). Affectionate communication, therefore, existed in some form long before researchers conceptualized or invented the term. Selection variables involved in affectionate communication might have included the consequences of being banished from a group, benefits of cooperating with group members, or genetic benefits of procreation. Mechanisms that mediated affectionate communication might also be attributed to pressures of reciprocal altruism. Social support, even if it is expected to be reciprocated, could be perceived as affectionate communication by both the sender and receiver. Affection certainly plays a role with genetic relatives by compelling a human to offer safety and provision for its offspring or other kin through "attempts" by the genetic code to ensure its successful replication. Again, the optimon's phenotypes simply direct the organism to aid those individuals who are more likely to share the same genetic code (Tooby & Cosmides, 1992).

Third principle of evolutionary psychology

Evolutionary psychology's *third principle* states that what humans consciously experience is the Freudian "tip of the iceberg." It offers that what humans think are simple problems to solve, cognitive-wise, are in fact very difficult. To illustrate, it is useful to consider the difficulty in programming a computer to do the things that a human child can do, such as recognize a picture of a dog. Although pattern-recognition software is becoming increasingly sophisticated at an exponential rate, modern computers are not very good at recognizing objects like dogs, speaking and learning language, or other faculties that require massively parallel processing. It is therefore important not to underestimate the order and complexity of the circuits involved in what humans generally consider trivial psychological faculties (Cosmides & Tooby, 1997). What affectionate communication is at the most basic level, how it is manifest in overt behaviors, and the benefits and consequences of expressing and receiving it, all reflect incredibly complex algorithms.

Fourth principle of evolutionary psychology

Revisiting the problems that humans encountered during evolution, the *fourth principle* of evolutionary psychology also becomes appropriate to consider. This principle states that since there was a wide variety of adaptive problems in early humans, many different structures evolved to solve those problems. Although faculties can and sometimes do have more than one purpose, generally speaking, specialized tools do better at solving specific problems. In the brain, then, different structures would be expected to be responsible for mediating different functions. The brain is usually considered a single organ; however, it is more accurate to think of it as a set of interacting organs each of which has evolved in response to specific problems in the environment that our human ancestors faced. Each of the components (or organs) of the brain are not only specialized, but individual components develop and function without conscious effort. Therefore, in a very real sense, these organs constitute human nature. The question of whether a particular behavior is learned or innate, while common in communication, is not even considered in evolutionary psychology. From that perspective the appropriate question is "what instinct caused the learning?" (Cosmides & Tooby, 1997).

Fifth principle of evolutionary psychology

The fifth and final principle of evolutionary psychology is that the human brain is a stone-age tool. Picking up where the third principle left off—not only is human neural circuitry designed to solve problems appropriate to humans—it is designed to solve problems that humans encountered during the 10 million years that humans did not spend in modernity (i.e., the last few thousand years). The environment that humans now find themselves in is vastly different from the life of hunter-gatherers, but adaptations for hunting and gathering remain. In contrast, new adaptations are not readily apparent. For example, there are no structures in the brain that are specialized for accessing the Internet, driving a car in rush hour traffic, or even public speaking. When thinking about what structures one might expect to be find in the brain, one must think not in terms of the problems that modern humans face, but the problems faced by prehistoric hunter-gatherers. Thus, you see a tendency for people to experience apprehension or anxiety toward unfamiliar or uncertain environments, a characteristic that were selected for in ancient times, manifest in situations that (in modern life) do not present a viability threat to the organism (e.g., public speaking anxiety).

Evolutionary factors help to account for why there is variance in humans' thresholds for anxiety responses as well as affectionate communication, among other characteristics. Researchers should expect to see physical information-processing structures that are associated with tolerances for giving and receiving affectionate communication similar to those responsible for identifying negative or threatening stimuli in the environment (e.g., the anterior attention network).

Affection Exchange Theory

Affection Exchange Theory (AET) conceives of affectionate communication as an adaptive behavior that increases the chances of the genetic code responsible for the trait to be transmitted to future generations (Floyd, 2006b). This can manifest as the survival and procreation of the sender, the sender's offspring, relatives, or even a member of sender's group—so long as it adheres to the constraints provided in the neo-Darwinian mechanisms discussed earlier. According to Floyd, AET is not to be considered "an extension or modification of the theory of natural selection ... rather, [AET] treats affectionate communication as a class of behaviors that serves both the superordinate evolutionary goals (survival and procreation)" (2006b, p. 160), and the human motivations to meet these goals.

Postulate one

The *first postulate* of AET is that humans' need and capacity to give and receive affectionate communication is innate. As such, affectionate communication should be more consistent than inconsistent within individuals, across cultures, historical periods, and socially constructed class divisions. Of utmost importance to the current study, however, is that affectionate communication should not only be apparent in social behaviors but also in neurological structures and physiology of those who engage in it. Variation in the neuroanatomical structures and/or the functioning of those structures should correspond to variation in the tolerance for expressing affection and one's need to receive it. This innate human "need" also implies that increased expression of affectionate communication should be accompanied by overall improvements in mental and physical health. In contrast, the absence of a predisposition to express affection should be accompanied by detrimental effects.

Postulate two

The second postulate underscores the difference between affectionate feelings/emotions and affectionate expression. Although both phenomena often accompany one another, there is no necessity for them to co-occur. Assuming a certain degree of communication competence, individuals can generally *inhibit*, *simulate*, *intensify* or *deintensify* an emotional display according to cultural and situational "display rules." Likewise, humans can *mask* emotional experiences by displaying an emotion that does not correspond to their actual internal state (Ekman & Friesen, 1975). The operationalization of trait affection developed by Floyd (2002) has been shown to obtain reliable data on both aspects of the phenomenon.

Postulate three

Consistent with the scientific approaches detailed in the preceding sections, *the third postulate* states that affectionate communication benefits the viability or reproductive potential of both the sender and receiver due to its evolutionary origins as an adaptive trait.

That is, affectionate communication should improve the chances of achieving superordinal evolutionary goals. This postulate highlights the potential for studying particular physical structures and processes that mediate the mechanism through which the positive outcomes of affectionate communication are manifest. There are four subpostulates related to this concept. (s*ubpostulate 3a*,states that affectionate communication stimulates humans to form and maintain relationships with others. One can reason from this that affectionate communication serves to portray the sender as a capable parent (*subpostulate 3b*), which further improves an individual's reproductive potential. Due to the different sex roles in reproduction, female use of affectionate communication has a stronger relationship with increased reproductive potential (*subpostulate 3c*). That is, the theory assumes men use affectionate communication more than women to create sexual opportunity, that affectionate communication has been a *relatively* good strategy for this, and that women's use of affectionate communication is even more successful than for men in creating sexual opportunity. However, these assumptions/hypotheses have yet to be tested from the AET perspective. With specificity to the benefits of the physiological structures involved, affectionate feelings/emotions and sending or receiving affectionate messages covary with immunocompetence (an organisms' ability to resist illness and fatigue) and are mediated by physiological structures that exist for to promote or inhibit stress and reward (*subpostulate 3d*).

Postulate four

The f*ourth postulate* is of vital importance as it is on this assumption that one can expect to see variation in the expression of and tolerance for expressing affectionate messages. These concepts should be considered distinct from communication competence or other variables that might ultimately interact with *how effectively* particular messages are received or sent). It seems intuitive that the benefits to immunocompetence and reward/stress mechanisms are maximized when amounts of affectionate communication fall within these limits (*subpostulate 4a*). Likewise, children's reproductive success is maximized when caregivers' affectionate behaviors fall within these thresholds (*subpostulate 4b*).

Postulate five

Finally, the *fifth postulate* states that when individuals receive (or less often, send) affectionate messages outside one's threshold range (i.e., beyond what would be perceived as comfortable or desirable for that individual), a cognitive appraisal is stimulated by a stress response in the sympathetic nervous system. Thus, there is a cognitive or evaluative process triggered by the stress response similar to that of expectancy violation theory, indeed, this reflects the popular example: Suppose you received unexpectedly affectionate communication from another person. According to both EVT and the fifth postulate of AET, you would evaluate the message and the person to determine the appropriate response. However, the mechanisms upon which these theories are based differ dramatically. While EVT relies on contrast effects and higher-order cognitive processing to explain whether you would respond positively or negatively, AET uses biological framework. Ironically, both predict the same outcomes. For example, if the affectionate communication was unexpected but welcomed, a positive reaction is experienced. If it was unexpected and unwelcome, a negative reaction would be experienced. The difference is that AET would explain these outcomes in terms "flooding" the system with serotonin, dopamine, endorphins, and other "feel good" chemicals that evoke a positive response, or cortisol and other chemicals associated with heightened anxiety. Importantly, these activities are orchestrated by the central nervous system and the brain.

Personality Traits: Neurological Bases

Borne out of a perspective that combines the methods of brain science with the methods of social science, the levels of analysis typically found in human communication research should be examined in tandem with the physical variables of the brain, linking the structures and functions of the brain with social interaction. Research of this kind has been referred to by Cacioppo and Bernston (2005) as *social neuroscience* or s*ocial cognitive neuroscience.* It incorporates the biology-centered elements presented earlier with variables such as personality traits, psychological models, and social behaviors. Past research in temperamental expression and personality has been conducted under the auspices of social neuroscience, and has implications for where one should look in the brain to find variables affecting various behaviors. In their conceptualization of communication apprehension as temperamental expression, Beatty, McCroskey, and Heisel (1998) first articulated the relationship between communicative anxiety, personality, and neurobiological substrates. Their predictions were based upon the research generated by cognitive neuroscientists. Likewise, these same sources provide possible explanations for variation in thresholds for *giving* affection to others, as well as the areas of the brain likely to be complicit in these activities.

The Tripartite Model

Gray (1982, 1994) has provided a model of human neurobiological structure that underlies all temperamental variables—built with the reward-punishment architecture in mind. The model posits that (1) there are three basic systems in the mammalian brain that subserve emotion, motivation, and cognition, and (2) individual differences in these systems are what manifest as personality traits (Gray, 1994). According to this model, variation in trait affection would be a manifestation of variation in the three systems. Namely, the *behavioral approach system* (BAS), the *fight/flight system* (FFS), and the *behavioral inhibition system* (BIS). Individuals with low thresholds for BAS activation seek negative and positive reinforcement, show greater positive affectivity (Gable, Reis, & Eliot, 2000), and are more prone to engage in goal-directed endeavors (Gray, 1994). Those with a high threshold for BAS activation must experience stronger stimuli to trigger the same types of responses seen with low-threshold counterparts. Gray (1981, 1982a, 1982b, 1994) proposed that the BAS underlies feelings such as elation and hope. It consists of dopaminergic pathways, the basal ganglia and nuclei, and structures in the cortex (Carver & White, 1994). By contrast, individuals with a low threshold for BIS activation are more prone to anxiety because mechanisms in the BIS are more sensitive to negative or threatening stimuli, signals of punishment and nonreward, and evoke inhibitory responses to reduce or prevent actions or behaviors that could have negative consequences (Carver & White, 1994). As with the BAS, individuals with a high threshold for BIS activation require greater stimulation to provoke the same inhibitory responses as their low-threshold counterparts. The BIS consists of such structures as the amygdala and the hypothalamus (Gray, 1994). The current study does not focus on the FFS; however, this system plays an important role in detecting novel stimuli, creating a stress response, and stimulating one to make a behavioral choice when threat may be imminent (approach or withdrawal response) (Heisel, 1997).

Granted, it is rarely straightforward to classify emotions dichotomously as simply negative or positive (Solomon, 2007), and the BIS/BAS systems rely on stimulus and emotional valence in order to retain conceptual integrity. Individuals often pursue multiple goals while distancing themselves from various threats. Potential punishment can become potential reward, and vice versa. An event can be both a punishment and a reward at the same time (as in the case when one is winning a heated argument with his or her spouse). Simply put, there are different categories of threats and rewards. Carver and Scheier (1999) point out that *antigoals*, or potentialities from which an individual is actively attempting to distance him or herself, are also driving factors. Emotions like eagerness, sadness, fear, or contentment come from the "dynamic multi-state nature" of the approach and avoidance systems (Carver, Sutton & Scheier, 2000), not simply a "good-bad" dichotomy.

Personality and the Tripartite Model

The major dimensions of personality, according to Gray (1994), result from variation in parameter values of the two chief systems (BAS/BIS) in individuals. These parameter values represent sensitivities to the affective states for which the approach and avoidance systems are responsible. It has been noted that this model of temperament bears more than just a chance resemblance to Eysenck's *BIG THREE* personality system

(1986, 1990), as well as Costa and McCrae’s (1992) five-factor model. Eysenck's personality system posits three fundamental personality traits: psychoticism (P), neuroticism (N), and extraversion (E), which are also thought to underlie other, less fundamental traits. Eysenck believed that the three *supertraits* (so called because all other traits are believed to be derivatives) were mitigated by Intelligence (g). Similarly, Costa and McCrae’s five-factor model posits the existence of N and E, but includes agreeableness, conscientiousness, and openness rather than P. Both neuroticism and extraversion have significant correlations with the BIS and the BAS respectively. Several distinct research programs, each with different approaches, methods, and evidence, have converged on the idea that two systems regulate approach-related and withdrawal-related affect and behavior (Carver, Sutton & Scheier, 2000).

Although responses to affectionate communication have been linked to neurobiology (hemispheric dominance) using self-report data (Floyd, 2004; Mikkelson et al, 2006), trait levels of affectionate communication (thresholds for giving and receiving affectionate messages) in adults have not been directly investigated with regard to brain structure using traditional neuroscientific methods. Communication traits, as all other social and behavioral variables, can be conceptualized as reflections neurobiological systems—and all of emotional regulation is subserved by the same two behavioral or motivational systems (approach-withdrawal, appetitive-aversive). As a result, most variables do not measure discrete constructs (Heisel, 1997). Trait affection levels are not distinct from other trait variables like the BAS/BIS system or other personality systems. Indeed, Floyd (2005) found a correlation of .61 between Eysenck’s (1986, 1990) personality dimension extraversion (E) and Floyd's (2002) trait affection given scale (TAS-G). Likewise, he found an inverse relationship between Eysenck's psychoticism (P) and neuroticism (N) scales and his Trait Affection Scale (TAS-G). If E is fundamentally conceptualized as the tendency to approach social interaction opportunities to gain potential rewards or avoid potential punishments then it could be that neurologically, approach and avoidance simply reflect more refined and accurate ways of conceptualizing human temperament when compared to other personality systems. Theorists do not agree, however, on which qualities should be categorized under these fundamental personality traits. Eysenck included different qualities at different times, and McCrae and Costa's five-factor model includes aspects under N (like hostility and impulsiveness) that load just as highly on E and conscientiousness. Indeed, these factors seem to integrate better with the approach and withdrawal framework (Carver, Sutton & Scheier, 2000).

Asymmetrical Neurological Activation

According to Davidson (1992a, 1992b, 1995, 1998) clinical and laboratory observations suggest that the right and left prefrontal cortices mediate behavioral inhibition and behavioral activation, respectively. Clinical reports have shown that patients with lesions or other damage to the left *prefrontal cortex* (PFC) report higher depressive symptomatology than patients with damage to other regions (Sutton & Davidson, 1997). Using electroencephalograph (EEG) to measure electrical activity in the brain, Wheeler, Davidson, and Tomarken (1993) confirmed their prediction that greater relative left PFC activation would be associated with more positive affective reactions to films, whereas greater relative right PFC activation would be associated with more negative affective reactions. In another study, greater relative right PFC activation was observed in social phobics' waiting to deliver a speech (Davidson, Marshall, Tomarken, & Henriques, 2000). Using baseline recordings, Kang et al (1991) found that greater relative left activation was associated with several variables associated with higher immunocompetence and greater relative right activation with lower immunocompetence. Research in other labs suggest that (1) there are stable individual differences in the level of electrical activity in these laterally-opposed circuits, (2) that these differences are related to temperament, and (3) a number of personality traits are associated with the cortical areas involved. Baseline EEG data show that asymmetry detected using electrodes placed on top of scalp regions that reflect right and left PFC activity are reliable over time and have excellent internal consistency (Sutton & Davidson, 1997). In fact, Sutton and Davidson (1997) found that asymmetrical activation (that is the relative imbalance between the amount of resting electrical activity detected in the right and left prefrontal cortices) gave an r^2 value of .26 when compared to Carver and White's (1994) assessment of BAS and BIS indices. This study and other research (e.g., Davidson, 2004) indicates strongly that the left PFC mediates at least some components of the BAS. Research in anterior brain asymmetry has evolved over the past three decades from a model concerning the processing of positively and negatively valenced stimuli, to one that is beginning to put together the massively complex puzzle of how the BAS/BIS processing structures are mediated by the different circuits in the right and left PFC (Carver, Sutton & Scheier, 2000; Davidson, 2004).

Purpose of the Study

Highly affectionate communicators are constantly seeking the incentives of the positive affectivity associated with the (usually) social object of the reaction. Therefore, affectionate feelings and behaviors seem to be clear consequences of BAS activity. Affectionate communication also seems to have less conceptual confusion when compared to more general qualities such as impulsiveness or hostility. Because affectionate communication can be conceptualized as a derivative of more fundamental personality traits associated with asymmetrical activation, it is likely that thresholds for affectionate communication can be differentiated on this basis.

> Hypothesis 1: Variation in baseline activation in the left and right PFCs will predict variation in the self-reported assessments of trait affection-giving.

Consistent with studies such as Davidson, Marshall, Tomarken, and Henriques (2000) and Sutton and Davidson (1997), asymmetrical activation is expected to be valenced to the left or right PFCs when predicting higher or lower levels of trait affection-giving.

> Hypothesis 2: Individuals who report high levels of trait affection-giving will have asymmetrical baseline activity reflecting greater relative right PFC activity.

Trait levels of affection should be moderated by a brain's more fundamental temperamental processing style (i.e., the parameter values for how strongly or sensitively approach and avoidance systems function). Individuals high in trait BAS should actively seek out the dopamine reward associated with affectionate communication. Because of this, confirmation of the hypotheses would be consistent with the approach-withdrawal model of asymmetrical PFC functioning.

Individual differences in orientation toward and use of emotional communication have sometimes been linked to sex (e.g., Guerrero, Jones, & Boburka, 2006). Although asymmetrical processing has not been explicitly identified as a mechanism for differentiating sex, variation in relative left versus right PFCs might inform previous studies.

> Research Question 1: How is asymmetrical processing in the left and right PFCs related to sex?

Similarly, it is reasonable to ask what relationship (if any) exists between trait affection and sex. Studies conducted using the trait affection scale have reported differences (Floyd, 2006a), but did not make attributions regarding these differences.

> Research Question 2: What is the relationship between self-reported scores on the trait affection scale, sex, and asymmetrical PFC activation?

Finally, Gray's (1994) approach and withdrawal constructs have been measured by different survey instruments, the items of which do not seem to focus on social variables like affectionate communication. For comparative purposes, it might therefore be useful to determine the relationship between one of these scales and the trait affection index. Carver and White’s (1994) BAS/BIS instrument appears to be an appropriate candidate:

> Request Question 3: What is the relationship between BIS/BAS subscales and asymmetrical PFC activation?

Research Question 4: What is the relationship between trait affection and self-report data on BAS/BIS levels?

The answers to these last questions have methodological significance for several reasons. First, differences between trait affection and BAS/BIS scales in relation to asymmetrical activation might reveal the need for a different operational definition of the instruments. Second, because the BAS/BIS scale uses non-social reward seeking behaviors, it might differentiate between those individuals who actively seek nonsocial rewards, those that actively seek social rewards, and those who seek both through the expression of affection.

Chapter Two:

Method

General Procedure

Two hundred and ninety students enrolled in undergraduate communication courses at a mid-size Midwestern university completed an online survey that included indices measuring the dependent variables. This sample was disproportionately weighted in terms of sex with 67.1% female (n = 198), 26.5% male (n = 77), and 6.4% (n = 15) unreported. In terms ethnicity, participants were relatively diverse with 69% Caucasian (n = 191), 24.5% African American (n = 68), 4% Asian (n = 11), 2.2% Hispanic or Latino (n = 6), and 2.5% unreported (n = 7). The average age was 27.8 years. Upon completion of the questionnaire (which included a battery of dependent variables that measured personality and communication traits), participants were asked if they would be interested in learning more and possibly participating in a follow up study using EEG. The EEG data would serve as the independent variable. The majority of respondents indicated interest (69%, n = 202), while 25% declined (n = 74) and 5% (n = 14) did not respond. Participants who completed the original study were then provided with a copy of an informed consent letter describing the procedures and invited to reserve times to come into the EEG lab for data collection purposes. Cortical activity was recorded via EEG for a total of 32 participants more than two weeks after the online survey was completed. However, a number of participants were eliminated because of systematic instrumentation error [excessive microvolt (μV) levels] due to external artifact. This type of error is generally the result of electromagnetic waves that are not corrected for by the EEG software. As a result, analysis of all independent and dependent variables was limited to 16 subjects.

The final sixteen participants were surprising similar to the original sample, with 68% female (*n* = 11), 32% male (*n* = 5), an average age of 25.6 (*n* = 16, *sd* = 8.85), and a reasonably diverse ethnic pool 6% African American (*n* = 1), 12% Asian (*n* = 2), 69% Caucasian (*n* = 11), and 12% unreported (*n* = 2). The entire study was approved by the university's institutional review board.

Independent Variables

The independent variables in this study included Floyd's (2002) Trait Affection Scale (TAS-G) and Carver and White's (1994) BAS/BIS inventories. The TAS-G consists of ten positively and negatively valenced items which measure the participant's self-perception of his or her affection or affection orientation (see Table 1 for scale items). Items in this scale were measured using a 5-point Likert-type scale ranging from strongly disagree to strongly agree with a neutral midpoint. The TAS-G was found to be highly reliable (Cronbach's α = .93).

Table 1

Trait Affection Scale – Given (TAS-G) (Floyd, 2002)

I consider myself to be a very affectionate person.
I am always telling my loved ones how much I care about them.
When I feel affection for someone, I usually express it.
I have a hard time telling people that I love them or care about them.*

Table continues

Table 1 (continued)

Trait Affection Scale – Given (TAS-G) (Floyd, 2002)

I'm not very good at expressing affection.*
I'm not a very affectionate person.*
I love giving people hugs or putting my arms around them.
I don't tend to express affection to other people very much.*
Anyone who knows me well would say that I'm pretty affectionate.
Expressing affection to other people makes me uncomfortable.*

*reverse scored

Carver and White's (1994) Trait BIS/BAS scale is a composite measure that conceptualizes behavioral inhibition as a unidimensional construct measured by seven positively and negatively valenced Likert-type items ranging from strongly disagree to strongly agree with a neutral midpoint. With items focused on avoidant and neurotic orientations, the BIS subscale (see Table 2 for scale items), produced a satisfactory reliability in this study (α=.73).

Table 2

Behavioral Inhibition System (BIS) (Carver & White, 1994)

If I think something unpleasant is going to happen I usually get pretty "worked up."
I worry about making mistakes.

Table continues

Table 2 (continued)

Behavioral Inhibition System (BIS) (Carver & White, 1994)

Criticism or scolding hurts me quite a bit.

I feel pretty worried or upset when I think or know somebody is angry at me.

Even if something bad is about to happen to me, I rarely experience fear or nervousness.*

I feel worried when I think I have done poorly at something.

I have very few fears compared to my friends.*

*reverse scored

In contrast to the behavioral inhibition system scale, behavioral activation was conceptualized by Carver and White (1994) as a multidimensional construct including a five item measure for *reward responsiveness* (BAS_{rr}), *drive* (BAS_{d}), and *fun-seeking* (BAS_{fs}). The reward responsiveness subscale of the BAS (see Table 3 for scale items) is measured using five positively valenced items focusing on rewards. The reliability for the BAS_{rr} was very good (α=.88).

Table 3

Behavioral Activation System – Reward Responsiveness (BAS_{rr}) (Carver & White, 1994)

When I get something I want, I feel excited and energized.

When I'm doing well at something, I love to keep at it.

Table continues

Table 3 (continued)

Behavioral Activation System – Reward Responsiveness (BAS_{rr}) (Carver & White, 1994)

When good things happen to me, it affects me strongly.
It would excite me to win a contest.
When I see an opportunity for something I like, I get excited right away.

The BAS drive subscale is composed of four positively valenced items focusing an individual's motivation to seek out things that they want. Although related to reward responsiveness—which measures how individuals feel about the rewards they acquire—drive measures the degree to which people are motivated or driven to achieve desirable outcomes (see Table 4 for scale items). The reliability for the BAS_d subscale was excellent (α=.90).

Finally, the BAS fun-seeking subscale consists of four positively valenced items measuring an individual's orientation toward sensation seeking, spontaneity, and openness to experience which are anticipated to be rewarding or fun (see Table 4 for scale items). The BAS_{fs} subscale produced acceptable reliability with (α=.76). Although the weakest of the behavioral activation system subscales, BAS_{fs} alpha coefficient was still higher than the unidimensional BIS subscale (see Table 5 for BAS_{fs} subscale).

Table 4

Behavioral Activation System – Drive (BAS_d) (Carver & White, 1994)

When I want something, I usually go all-out to get it.

I go out of my way to get things I want.

If I see a chance to get something I want, I move on it right away.

When I go after something I use a "no holds barred" approach.

Table 5

Behavioral Activation System – Fun Seeking (BAS_{fs}) (Carver & White, 1994)

I will often do things for no other reason than that they might be fun.

I crave excitement and new sensations.

I'm always willing to try something new if I think it will be fun.

I often act on the spur of the moment.

Convergent Validity

To determine the convergent validity of the trait affection scale (TAS-G), participants completed the ten negatively valenced items from Infante and Wigley's (1984) verbal aggression scale (VAS). Verbal aggression has been conceptualized as an attack on the self-concept of another person (Infante & Wigley, 1986). Although Infante, Martin, and Brunig's (1994) study identified both positive and negative aggressive message categories, none of them are conceptually consistent with affectionate communication. For example, the six categories of verbally aggressive messages that were evaluated positively included instances of competition, teasing, motivation, challenging authority, manipulation, and interaction with intimate others. Given that each of these involved an attack on the self-concept, we would expect a negative relationship between trait affection and trait verbal aggression in the best-case scenario. The negatively evaluated categories (i.e., relationship termination, being the target of teasing, fighting, getting into trouble, and being criticized) of verbal aggressive messages are even less likely to have a positive association with the TAS-G. Therefore, to assess the convergent validity of these constructs, the scales were correlated to determine whether the relationship between the two constructs was in the expected direction. The composite score on the trait affection scale (TAS-G) was compared to negatively valenced items in Infante & Wigley's (1986) verbal aggression scale (VAS). Although the original VAS included a total of twenty items (10 negative, 10 positive), later research (e.g., Levine et al, 2004) used confirmatory factor analysis which demonstrated two distinct factors (verbal aggression and self esteem affirmation/supportiveness) in the scale. Using only the negatively worded items that measured verbal aggression (see Table 6 for selected items), as a result, produced better reliability than the original scale. Alpha reliability for the 10-item measure was excellent (α=.93), providing further evidence that the strategy was appropriate.

Table 6

Negatively Valenced 10-Item Verbal Aggression Scale (derived from Infante & Wigley, 1986)

When individuals are very stubborn, I use insults to soften the stubbornness.

When people refuse to do a task I know is important without good reason,

I tell them they are unreasonable.

If individuals I am trying to influence really deserve it, I attack their character.

When people behave in ways that are in very poor taste,

I insult them in order to shock them into proper behavior.

When people simply will not budge on a matter of importance

I lose my temper and say rather strong things to them.

When individuals insult me, I get a lot of pleasure out of really telling them off.

I like poking fun at people who do things which are very stupid,

I insult them in order to stimulate their intelligence.

When nothing seems to work in trying to influence others,

I yell and scream in order to get some movement from them.

When I am not able to refute others' positions,

I try to make them feel defensive in order to weaken their positions.

In addition, the correlation derived between the two indices was substantial, significant, and in the expected direction. The uncorrected correlation between TAS-G and the VAS-10 was r (32) = -53, $p < .05$ (corrected r = -.58). The relatively large negative correlations suggest that conceptual measurement in the TAS-G scale was working properly.

To further evaluate how the TAS-G scale related to other, conceptually related variables, participants completed Eysenck's (1986) short-form neuroticism scale (see Table 7). Neuroticism has been negatively correlated to the TAS-G in past research (Floyd, 2005), and this relationship should be replicated.

Table 7

Short-form Neuroticism Scale (Eysenck & Eysenck, 1985)

Does your mood often seem to go up and down?
Do you ever feel 'just miserable' for no reason?
Are you an irritable person?
Do you often feel 'fed up'?
Are you often troubled by feelings of guilt?
Would you call yourself a nervous person?
Would you call yourself tense, or 'highly strung'?

Table continues

Table 7 (continued)

Short-form Neuroticism Scale (Eysenck & Eysenck, 1985)

Do you often feel that life is very dull?
Do you often feel lonely?

As previously found with verbal aggression the correlation between Neuroticism and trait affection was substantial, significant, and in the expected direction. The correlation between TAS-G and N was substantial whether corrected [r (32) = -.85, $p < .01$] or uncorrected (r = -.73). Although this relationship was larger than previously reported [Floyd (2005) found a relation of only -.22 and N], it is consistent directionally with prior research and provides additional support for the independent variable.

Laboratory Procedures

After completing the survey and reserving a time, participants came to the EEG lab for data collection. The researcher briefed participants upon their arriving at the lab, and then led them to a cubical where they read and signed an informed consent agreement (see appendix A). Participants then reported sinistrality (handedness), as hemispheric laterality is reversed in approximately 30 percent of left-handed individuals' brains (Knecht et al, 2000). Next, the researcher determined the appropriate sensor array to use given the participants' head size and allowed the participant to initially place the cap on his or her head before visually inspecting the alignment of the cap according to the nasion, vertex, and inion). Each sensor array consists of 34 silver-silver chloride (Ag/AgCl) sintered electrodes placed in a spandex cap designed to simulate the International 10-20 electrode placement system (Harner & Sannit, 1974). The sensor array includes six additional electrodes which must be placed manually using double-sided adhesive discs. One referent electrode was placed on each earlobe while the four remaining electrodes were placed to the left and right of each eye, and above and below the left eye. Once all electrodes were placed, each electrode was "loaded" using a blunt nosed syringe filled with an electrolyte gel to decrease electrical resistance between the participant's scalp and the surface of each electrode.

The sensor array itself was connected to a 40-channel Compumedics/Neuroscan electroencephalograph (EEG amplifier) used to record the electrical signals detected by each electrode. Data from the amplifier was then delivered to a monitoring computer for review and analysis.

Impedance Check

Impedance was calculated for each electrode using software applications stored in the monitoring station computer. It is generally accepted among cognitive neuroscientists that low impedance values are essential to collecting high-quality EEG data (e.g., Beatty & Heisel, 2007). While individual researchers have different methods for determining acceptable impedance levels, one common strategy is to determine maximum impedance values based on the technical specifications of the EEG used. Using a simple formula, one can calculate that an EEG amplifier with an input impedance of 80 MOhms, the impedance for individual electrodes should not exceed 80 kOhms (Picton et al., 2000; Pivik et al., 1993). In this study, the impedance values quite good, with average impedances that were little more than one tenth the maximum (see Table 8).

Dependent Variable

The dependent variable in this study was the asymmetrical processing in the left and right prefrontal cortices. Asymmetry was operationalized as the difference between the following two clusters of electrodes: FP1, FC3, F7 and FP2, FC4, F8. These electrodes have been associated with asymmetrical PFC activity (evidence indicates that alpha power in baseline recordings is inversely related to cortical activity) and are used in researching anterior brain asymmetry (e.g., Minnix & Kline, 2004). The average difference between microvolt levels of opposing clusters of electrodes on the sensor array serve as the dependent variable in this study.

Table 8

Basic Statistics for Impedance in Electrodes Measuring Left and Right PFC Activity

Electrode name	Minimum	Maximum	M	SD
FP1	2	34	11.20	7.91
F3	1	26	9.20	7.71
F7	2	18	7.20	5.05
FP2	2	32	10.07	7.46
F4	4	36	11.87	8.21
F8	1	34	9.47	10.18

Chapter Three:

Results

Hypothesis one predicted that scores on the trait affection scale - given (TAS-G) would be significantly related to asymmetrical activation in the left and right prefrontal cortices. Asymmetrical activation levels were calculated by comparing absolute relative activity in each cluster with the composite score on the TAS-G. A preliminary test of this hypothesis was conducted using the Pearson product moment correlation coefficient. Uncorrected, the correlation between TAS-G and PFC asymmetry [r (16) = .73, $p < .01$] was both large and significant. Using impedance values of the electrodes as estimates of reliability, a corrected correlation for TAS-G and PFC asymmetry of $r = .81$, $p < .01$ was found. Thus, preliminary examination provides support for hypothesis one.

To test whether trait affection giving (TAS-G) would predict PFC asymmetry, data for the TAS-G was dichotomized into high and low scores using the mean. A discriminant analysis using high and low trait affection to predict PFC asymmetry resulted in 81.3% correct classification [F (1, 14) = 17.36, $p < .001$, Wilks' $\lambda = .45$, canonical correlation = .896). Interestingly, when the TAS-G was dichotomized using extreme scores (one standard deviation above and below the mean), the discriminant analysis achieved 100% correct classification [$F(1, 5) = 20.36$, $p < .01$, Wilks' $\lambda = .197$, canonical correlation = .896). Taken together, these findings support hypothesis one.

Hypothesis two predicted that the relationship between asymmetrical processing and TAS-G would be characterized by greater activation in the right relative to the left prefrontal cortex. More specifically, that lower TAS-G scores would be associated with greater activation in the right PFC (relative to the left), whereas higher TAS-G scores would be associated with reduced activation in the right PFC (relative to the left). Because alpha power is inversely related to cortical activity (Coan & Allen, 2004), asymmetry scores should be inversely correlated to left PFC dominance (consistent with the hypothesis). Using asymmetry scores in which activation in the FP1, F3, and F7 were subtracted from activation in FP2, F4, and F8, the directionality was consistent with expectations [$r = -.73$, $p < .01$], indicating right PFC activation was greater when TAS-G scores were lower. Participants reporting a low level of affectionate communication were more likely to have asymmetrical processing characterized by right PFC activation. Hypothesis two was therefore supported.

Research question one investigated the relationship between left and right PFC asymmetry and biological sex of the participant. An analysis of variance was conducted to test mean differences for PFC asymmetry between males (see Table 8 for means and standard deviations).

Table 9

Means and Standard Deviations for Biological Sex

	N	*Mean*	*SD*
Males	5	-14.44	13.65
Females	10	12.61	14.26

A significant difference for sex was detected [F (1, 14) = 12.32, $p < .01$], Cohen's $d = 1.94$, $r = .695$] meaning that the data indicated that PFC asymmetry was related to biological sex. This relationship was characterized by reduced relative activation in the right PFC for males.

The second research question addressed the relationship between biological sex, trait affection given (TAS-G), and asymmetrical PFC activation. Testing for differences between TAS-G and PFC asymmetry (controlling for biological sex using ANCOVA) produced a nonsignificant result, meaning that when the effects of sex are removed, the relationship between TAS-G and asymmetry do not hold. An examination of the correlation matrix, however, produced some unexpected results. Biological sex was positively related to asymmetry [uncorrected $r = .698$, $p < .01$], but negatively related to TAS-G [uncorrected $r = -.60$, $p < .05$]. Using ANOVA to test mean differences between TAS-G and biological sex confirmed that there was a significant difference [F (1, 14) = 7.16, $p < .05$, Cohen's $d = 1.62$, $r = 0.63$]. The average score on the TAS-G for males (n = 5) was 31.2 (sd = 3.9), while the average for females (n = 15) was 21.5 (sd = 7.5). Inconsistent with previous literature (e.g., Floyd, 2007), females reported lower levels trait affection given than males in this sample.

The third research question addressed the relationship between the BIS/BAS subscales and asymmetrical PFC activation. Of the four subscales, only BASd (drive) and BASfs (fun-seeking) produced significant correlations with PFC asymmetry [uncorrected $r = .63$, $p <. 01$] and [uncorrected $r = .61$, $p < .05$], respectively. When corrected for attenuation, the correlations increased to .76 for BAS_d and .74 for BAS_{fs}.

The last research question investigated the relationship between trait affection given and the BIS/BAS subscales. Correlation analyses revealed a number of interesting results (see Table 10). Most surprising, only one of the four subscales produced a significant correlation. The behavioral activation system subscale for drive (BAS*d*) approached significance, but only the fun-seeking subscale (BAS*fs*) actually achieved significance.

Table 10

Uncorrected and Corrected Correlations: TAS-G and the BIS and BAS Subscales

	BIS	BAS_{rr}	BAS_{d}	BAS_{fs}
TAS-G (uncorrected)	-.01†, *n* = 16	.08†, *n* = 15	-.47*, *n* = 16	-.52 **, *n* = 16
TAS-G (corrected)	-.01	.09	-.53	-.63

* approached significance with $p = .066$

** significant with $p < .05$

†not significant

Chapter Four:

Discussion

The results of this study suggest that trait affection is consistent with the trait approach-withdrawal model of asymmetrical PFC functioning. They are also consistent with the proposition that the left PFC plays a central role in stimulating individuals to express affection, and when this affection is expressed the body is less prone to stress. Affectionate communication has been confirmed as part of a fundamental motivational drive that stimulates humans to form relationships that facilitate cooperation, and individual differences in PFC functioning manifest as individual differences in amounts of affection expressed. Certainly, other neurological structures play important roles in the tendency to express affection, and these structures are likely to also play roles in more fundamental human temperamental traits.

According to Goleman (2006), the left PFC is able to ignore patterns of activity originating from the limbic system (a source of stress responses), as well as able to extinguish these stress responses by triggering appropriate activity patterns to subdue the lower emotional centers. The study of these emotion-related structures (often called *affective neuroscience*) has led to the term *emotional regulation* because of the left PFC's ability to downregulate or minimize emotional responses. The right PFC is linked to these emotional structures in the mammalian brain such that it cannot control or ignore the stress responses. Observations in the asymmetry literature are less consistent. Little consensus exists regarding exactly how the right PFC is related to behavioral outcomes and whether it mediates behavioral withdrawal or is simply less sensitive to reward. In contrast, the evidence linking left PFC to behavioral approach is quite robust, despite the opposite finding in this study. Regardless, both the left and right PFCs are likely to play a role in influencing individuals' thresholds for expressing affection. Differentiating between these two areas of the brain might reveal individual differences in other physical markers related to health, or previously unnoticed phenomena that are manifest in social exchanges.

Davidson, Marshall, Tomarken, & Henriques (2000) hypothesized that the approach and withdrawal systems will be related to pre-goal-attainment emotions (reward expectation), such as enthusiasm, rather than post-goal attainment emotions such as contentment. This distinction is important because it suggests that approach motivation is important to the expression of affection (suggesting left PFC involvement), and evokes the question of which roles the PFC plays in the two types of processing (i.e., both seeking [motivational] to express affection and the rewards of expressing [emotional] affection). Evidence has accumulated that suggests the PFC is much less active in post-goal attainment measurements (Davidson, 2004). The findings are also relevant to positive psychology as both affectionate communication (sending and receiving) and prefrontal asymmetry has been linked to a myriad of health variables. Asymmetry is one variable that is connected to an individual's physical health, and findings such as these may contribute to an understanding of how clinicians and patients can profit from using affectionate communication or pharmacological interventions to improve wellbeing. Finding out which affective states are related to other individual differences in neurological structure and health markers could be very useful to mental health practitioners. Future research should aim to link these structures to the hypothalamic-pituitary-adrenal axis, autonomic and sympathetic nervous systems (among other biological structures) to reveal the processes that explain the covariance between health markers and trait affection.

Other studies focusing on affection have examined developmental issues (e.g., Prescott, 1970), encoding and decoding processes (e.g., Burgoon, 1991), and gender differences (e.g., Mormon & Floyd, 2004), among other facets. Floyd's (2002, 2006a, 2007) work has been central to the development of a literature of affectionate communication and how it relates to temperamental expression, as well as to a host of physical markers such as immunocompetence, cardiovascular health, and hormonal variation. This study is unique in that it is the first to link trait affection to brain activity and region, and thus exposes a puzzle-piece for understanding the structures underlying temperament from the AET perspective.

The data show interesting results for all of the research questions. For RQ_1, data indicate that males showed less baseline activity in the right PFC than females. This finding is consistent with dramatically lower prevalence of depression among men (e.g., Burker et al., 1995), as higher activation in this region has been associated with depression and negative affect (see Minnix & Kline, 2004 for a review of this literature). Females showed more activity in the right PFC. Past neurological research has revealed a myriad of sex differences related to brain asymmetry in general (Toga & Thompson, 2003); however, sex differences regarding baseline EEG recordings of the anterior portion of the brain have not been reported. This finding may warrant a replication study to determine whether this is an externally consistent observation.

Research question two shows that both sex and asymmetry covary with TAS-G. Although sex and asymmetry have not been reported to covary in past research, this finding does not contradict the significant relationship between TAS-G and asymmetry. Females in the sample displayed greater relative right activity and less left PFC activity, when compared to their male counterparts, but making generalizations about this finding could be premature as the sample size *(N=16)* is relatively small and may not be representative of the larger population. Future research is needed to interpret this finding.

Next, the study sought to address the relationship between the BAS/BIS variables and asymmetrical PFC activation. Past research has strongly indicated that the BAS is connected to the left PFC in individuals with standard neurological profiles (e.g., Davidson, 1997; Minnix & Kline, 2004). That is, individuals with high BAS scores have shown greater relative baseline activity in the left PFC compared to the right PFC. This investigation produced the opposite result in which there was an inverse correlation between BAS (BAS_d and BAS_{fs}) and left dominance. This inconsistent finding will be discussed in the following section as it raises questions about the potential non-validity of the BAS survey instrument, or other potential instrumentation error unique to this investigation. Also, the possibility of respondent fatigue may have played a factor, as there were approximately 120 survey items participants provided responses to before completing the BAS/BIS scales (although the same is true for the TAS-G). Similarly, cognitive priming may have played a role in stimulating participants to report responses to items that, had the TAS-G been administered alone, would have been answered differently.

Finally, the BAS_{fs} was the only variable to produce a significant correlation with the TAS-G (although BAS_d approached significance with $p < .066$). Both constructs are supposed to refer to sensitivities to different types of reward, and trait affection is likewise conceptualized as sensitivity to a type of reward. However, both the BAS_d and BAS_{fs} were *inversely* correlated to the TAS-G. The results suggest a distinction, and potential conflict, between sensitivities to different kinds of rewards (i.e., material versus social). However, the findings regarding trait affection and asymmetry should raise questions about the external validity of these inverse correlations.

Strengths and weaknesses

As mentioned, correlations for the BAS_d and BAS_{fs} with asymmetry did not go in the expected direction with regard to asymmetry. These scales have had relatively low (.60) alpha reliabilities in the past (e.g., Diego, Field, & Hernandez-Reif, 2001) while the current study reported alpha reliability coefficients of .90 and .73 for BAS_d and BAS_{fs}, respectively. Past studies have also reported test-retest reliabilities ranging from .45 to .81 (see Sutton & Davidson, 1997 for a full account). The relatively high reliabilities make the lack of relationship between left PFC and BAS unexpected. However, it is possible that an inverse relationship similar to alpha power in the right PFC may be responsible. Additionally, excessive μV activation may be due to an unidentified source of RF interference. Given this, a replication and extension of the study is warranted.

Secondly, although none of the participants had a reported history of psychiatric disorder, the participants were not explicitly screened for this potentiality prior to EEG data collection. If abnormalities (e.g., depression, post-traumatic stress disorder) existed among the subjects in the study—it remained unknown to the researcher (see Sutton & Davidson, 1997 for an example of this type of pre-screening with regard to the BAS/BIS).

The next potential weakness of the investigation was that a large number of variables measured during the survey phase of the study. University students provided responses to 161 items for extra credit in their communication courses; therefore, participant fatigue, unintentional priming, or carelessness could help explain the BAS/BIS variables' inconsistency with past research. However, the significant and expected correlations between the other variables (TAS-G, VAS, N) makes this somewhat untenable. Given the large effect sizes and correlations reported in this study, the validity of the BAS/BIS survey instrument may be at issue. Carver and Sutton (2000) have noted the lack of any social rewards or punishers (e.g., affection, loneliness) in the scales, and have proposed the creation of a survey instrument that combines the social aspects of E and N with the approach-withdrawal model. In the context of affectionate communication, this certainly makes sense. A related strength of the study is the relatively long duration of time (several weeks) between self-report data collection and physiological data collection.

In addition, while all of the participants reported their dominant hand to address potentially reversed/attenuated hemispheric laterality, no validation test was conducted. Albeit, there were only two left-handed participants in the study, which does not necessarily merit a statistical correction. Participants were asked verbally to report whether they were left or right-hand dominant. More thorough methods of assessing handedness exist and should be used in any future investigation (e.g., see Chapman & Chapman, 1997 for Chapman Handedness Inventory) to be be more certain of potential attenuated/reversed brain laterality.

Another weakness of this study is that no variables were manipulated and as a result conclusions about causality of any specific affection-related phenomenon cannot be made. However, the significant correlations in this study and in past PFC asymmetry research strongly suggest that the left PFC (most likely in the dorsolateral area, see Davidson, 2004) is associated with affective states of brains when seeking to express affection. It is functionally different from individual to individual, and this difference reflects aspects of trait affection.

Finally, an important strength of this study was that it did not rely completely on self-report data. The physiological measurement of PFC activation with EEG provided another way of examining trait affection that is not affected by participants' self-perceptions. To the extent that individuals cannot consciously manipulate *uV* activation in the left and right PFCs, differences detected should reflect relationships unfiltered by social desirability or selective perception. Indeed, while the sample size was relatively small, Davidson's (1994, 1997) studies have used similar sizes (10 and 23, respectively). Nevertheless, a social desirability bias may still be a factor as the independent variables were measured using self-reports.

Directions for future research

The weaknesses of this study should be remedied by prescreening participants for abnormalities, using a more thorough handedness inventory, and measuring fewer construct-variables simultaneously to reduce the potential for participant fatigue and carelessness.

In the short term, research should aim to map out the structures related to trait affection and affectionate communication in general to point out individual differences in neurophysiology that reflect variation in trait affection. A potentially fruitful research question is whether the left PFC plays a role in affectionate communication solely and directly, or whether the right PFC (due to stress originating in the limbic system) also prevents affectionate messages from being expressed in some way without regard to activity in the left PFC.

Next, it would be insightful to observe how highly asymmetrical individuals' behavior differs from those with more average asymmetries when delivering messages with varying degrees of affection (e.g., from simple eye contact, shaking hands, leaning toward message recipient, to speaking in high-pitched tones and affectionate touch). Floyd's (2004) study examined such reactions with relation to hemispheric dominance, but PFC asymmetry should provide completely different outcomes.

In the long-term, using asymmetrical EEG data to inform levels of analysis of dyadic affectionate communication, such as variables concerning parent-offspring communication, or romantic partner communication might reveal meaningful relationships and significant effect sizes. Indeed, neurological profiles may ultimately be identified. For example, one would expect that groups and dyads consisting of individuals with differing neurological profiles (asymmetry being a factor) would produce different behavioral patterns when compared to groups and dyads comprised of individuals with similar neurological profiles. When measurement and findings are sufficiently refined, then dyadic research regarding expressing affection using physical markers will become increasingly prevalent. Of course, many studies of individual differences in brain structure and fundamental personality will be required before any neurophysiologically-inspired model can be developed that does not vastly oversimplify the process.

Another question often raised concerning stable differences in temperament (and brain activity) is that of neural plasticity. Are people "doomed" to live their entire life with a particular dominant side of their PFC? Can individuals in unsatisfying relationships change their neural architecture behaviorally, pharmacologically, or with direct physical intervention in order to improve their overall wellbeing? Although evidence shows that temperament is highly heritable (i.e., at least partially genetically determined) this does not necessitate that genes are the *only* causal agents involved in forming temperament. As Davidson, Jackson, and Kalin (2000) point out, one of the major questions of the next few decades for affective neuroscientists is to figure out how the environment shapes neural circuitry throughout life. Some research has pointed to the idea that infancy and childhood are crucial periods when behavioral and environmental factors can change the emotional circuitry of the brain, but little to no longitudinal studies (along with measures of environmental change and emotional reactivity) have been conducted to test the variability of affective style in individual participants except in children, whose baseline EEG asymmetries are not as stable as in adults (Davidson, Jackson, Kalin, 2000). It is known that the emotional centers of the brain *are* an area of plasticity, which lends credence to the idea that environment can change the emotional circuitry. The degree to which this is possible and the nature of the changes are, however, problems that cannot be adequately addressed here and now.

The results of this study offer a small, “baby step” toward uncovering relationships between tendencies to express affection and individual differences in brain activity. How the relationships between personality, brain structure, function, and activity pan out has and will be largely be a function of psychophysiological research such as the current study.

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Appendix

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Informed Consent for Participation in Research Activities

The Utility of the Assymetric Processing Model to Explain Communicator Style

Participant ______________________ HSC Approval Number 070822H

Principal Investigators Alan D. Heisel PI's Phone Number (314) 516 - 6189

Why am I being asked to participate?

You are invited to participate in a research study about individuals' responses to hypothetical communication interactions conducted by Alan D. Heisel, Associate Professor and Chairperson of the Department of Communication at the University of Missouri-St. Louis. You have been asked to participate in the research because you expressed interest in the project and may be eligible to participate. We ask that you read this form and ask any questions you may have before agreeing to be in the research. Your participation in this research is voluntary. Your decision whether to participate will not affect your current or future relations with the University. If you decide to participate, you are free to withdraw at any time without affecting that relationship.

What is the purpose of this research?

The purpose of this research is to gain a greater understanding of why individuals respond differently in communication situations by examining differential activation in specific areas of the brain.

What procedures are involved?

The experimental procedure will require approximately 1 to 1 ½ hours to complete. The experiment involves the measurement of brain activation using an EEG (electroencephalograph). This is a non-invasive procedure, meaning that the measurement device is placed on you, not in you. You will be asked to wear a sensor cap (a spandex headpiece with embedded sensors) to take the measurements. Each sensor in the cap requires a small amount of gel to insure proper measurement. Once the sensor cap is in place and initial measurements are taken, you will be monitored for approximately 10 minutes to establish baseline activation levels. At the end of this period, you will be given the opportunity to play a selection of video games for ten minutes. At the end of the second time period, you will be asked to report which video games you chose to play and for how long. Once baseline and game data have been collected, the experimental procedure is over and the sensor cap will be removed. Shampoo and a towel will be available to wash any traces of the gel out your hair.

What are the potential risks and discomforts?

As with any physiological study, there are some potential risks and discomforts associated with participation. You will be asked to sit and minimize your movements for the duration of the experiment. Sensor caps are designed to be comfortable, but you may not like the feel of the cap on your head. The gel used on the electrodes may feel strange, cold, or uncomfortable. Wearing the sensor cap and using the gel will temporarily flatten and misshape hair, although no long-term effects will result.

Are there benefits to taking part in the research?

Participation in this study will help further our understanding of how the brain functions during communication events. In addition, you will have the opportunity to view EEG measurements of your brain if you request it.

What about privacy and confidentiality?

Protected Health Information (PHI) is any health information through which you can be identified. PHI is protected by federal law under HIPAA (the Health Insurance Portability and Accountability Act). The EEG (Electroencephalograph) does not record any information that would allow the participant to be identified and is not considered PHI under HIPAA guidelines.

The only people who will know that you are a research subject are members of the research team. No information about you, or provided by you during the research, will be disclosed to others without your written permission, except:

- if necessary to protect your rights or welfare (for example, if you are injured and need emergency care or when the University of Missouri-St Louis Institutional Review Board monitors the research or consent process); or
- if required by law.

The results of this study will be analyzed in aggregate form. When the results of the research are published or discussed in conferences, no information will be included that would reveal your identity. If photographs, videos or audiotape recordings of you will be used for educational purposes, your identity will be protected or disguised. Any information that is obtained in connection with this study, and that can be identified with you, will remain confidential and will be disclosed only with your permission or as required by law.

Responses to the questionnaire you completed earlier and the EEG recordings will be given a code number that allows the data to be identified as a single subject. However, no information regarding the identity of the participant will be retained. Once the responses to questionnaires have been entered into a computer, hardcopies will be stored at a secure location for a period of one year. At the end of this period, the hardcopies will be destroyed. Data will be stored electronically on a secured computer, and a backup copy will be made on CD Rom. The backup will be retained by the principal investigator and stored at a secure location.

Will I be paid for my participation in this research?

Participants will not be paid for participating in this study, but may receive extra-credit in certain communication courses.

Can I withdraw or be removed from the study?

You can choose whether to be in this study. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You also may refuse to answer any questions you do not want to answer and still remain in the study. The investigator may withdraw you from this research if circumstances arise which warrant doing so. If you decide to end your participation in the study, please inform the experimenter. Be advised that it will take a few minutes to remove the equipment, however. In rare cases, the experimenter may withdraw you from the study if technical difficulties are encountered (e.g., sufficient signal strength cannot be acquired from the sensor cap).

Who should I contact if I have questions?

The researcher(s) conducting this study are Professors Alan D. Heisel and Michael J. Beatty. You may ask any questions you have now. If you have questions later, or if you would like to review the results of the completed study, you may contact the researcher(s) at (314) 516 - 6189, (314) 516 - 6725, or (314) 516 - 5486.

What are my rights as a research subject?

If you have any questions about your rights as a research subject, you may call the Chairperson of the Institutional Review Board at (314) 516-5897.

What if I am a UMSL student or employee?

You may choose not to participate, or to stop your participation in this research, at any time. This decision will not affect your class standing, grade, employment, or benefits, privileges or opportunities associated with your employment at UMSL. The investigator also may end your participation in the research. You will not be offered or receive any special consideration if you participate in this research. Your participation in this research is voluntary. Your decision whether to participate will not affect your current or future relations with the University. If you decide to participate, you are free to withdraw at any time without affecting that relationship.

You will be given a copy of this form for your information and to keep for your records.

I have read the attached statement and have been able to express my concerns, to which the investigator has responded satisfactorily. I believe I understand the purpose of the study, as well as the potential benefits and risks that are involved. I authorize the use of my PHI and give my permission to participate in the research described above.

All signature dates must match.

____ ____
Participant's Signature Date Participant's Printed Name

____
Researcher's Signature Date